CLAIMS

1. An isolated DC-DC converter comprising:

a transformer that includes a primary coil, a secondary coil, and a tertiary coil that are electromagnetically coupled;

a main switching device that is provided on the side of the primary coil of the transformer and controls energy supplied from an external power supply to the primary coil by a switching operation to control a voltage generated in the primary coil;

a secondary-side rectifying and smoothing circuit that rectifies and smoothes an output voltage from the secondary coil corresponding to the voltage of the primary coil of the transformer and outputs a rectified and smoothed voltage to the outside;

a tertiary-side rectifying and smoothing circuit that rectifies and smoothes an output voltage from the tertiary coil to produce a direct-current voltage and detects and outputs the direct-current voltage as a detected voltage of the output voltage from the secondary-side rectifying and smoothing circuit; and

a control circuit that controls the switching operation of the main switching device on the basis of the detected voltage output from the tertiary-side rectifying and smoothing circuit so that the output voltage from the secondary-side rectifying and smoothing circuit is stabilized,

wherein the secondary-side rectifying and smoothing circuit includes a rectification-side synchronous rectifier and a commutation-side synchronous rectifier that perform a switching operation in synchronization with the switching operation of the main switching device as rectifying devices that rectify the output voltage from the secondary coil, and

the tertiary-side rectifying and smoothing circuit includes a commutation-side synchronous rectifier as a rectifying device that

rectifies the output voltage from the tertiary coil, the commutation-side synchronous rectifier being switched on when the main switching device is turned off.

2. The isolated DC-DC converter according to claim 1, wherein the main switching device is turned on when an input capacitance of the main switching device has been charged in response to a turn-on signal output from the control circuit,

further comprising an early-turn-off circuit that switches off the commutation-side synchronous rectifier of the secondary-side rectifying and smoothing circuit and the commutation-side synchronous rectifier of the tertiary-side rectifying and smoothing circuit before the main switching device is turned on during a period between the time when the control circuit starts to output the turn-on signal and the time when the main switching device is turned on, the input capacitance being charged in the period.

3. The isolated DC-DC converter according to claim 1, wherein the tertiary-side rectifying and smoothing circuit includes a rectification-side synchronous rectifier that is switched on during a period in which the main switching device is turned on in addition to the commutation-side synchronous rectifier.

4. The isolated DC-DC converter according to claim 2, wherein the tertiary-side rectifying and smoothing circuit includes a rectification-side synchronous rectifier that is switched on during a period in which the main switching device is turned on in addition to the commutation-side synchronous rectifier.